

REMARKS

Claims 18-29 are pending in this application, all of which are newly-added. Claims 1-17 have been canceled.

The Examiner has required a new, more descriptive title. The title has been so corrected.

The disclosure stands objected to for informalities which have been corrected in the aforementioned amendments to the specification.

Claims 1-5 and 9-14 stand rejected under 35 USC §102(e) as anticipated by U.S. Patent 5,917,546 to Fukui (hereinafter "Fukui").

Applicants respectfully traverse this rejection.

Fukui discloses an imaging apparatus in which the dynamic range can be substantially increased even with the use of a solid image sensor, such as a CCD image sensor. The imaging apparatus includes a solid-state imaging unit for reading out two picture signals with different signal charge storage time durations via a vertical transfer section and via first and second horizontal transfer sections for outputting all-pixel picture signals on the field basis, and a shutter control unit for providing different signal charge storage time durations of the solid-state imaging unit. The imaging apparatus also includes a synthesizing unit for synthesizing the two picture signals with different signal charge storage time durations produced by the shutter control unit.

According to claim 18 of the present invention, an imager includes a vertical transfer register having a plurality of transfer areas, a horizontal transfer register connected to an output terminal of the vertical transfer register, and a plurality of light-receiving elements respectively assigned to the plurality of transfer areas. The timing generator is connected to the imager, and

applies timing signals to the imager.

Herein, the timing signals include a first exposure signal for carrying out a first exposure of a first period, a second exposure signal for carrying out after the first exposure a second exposure of a second period, which is shorter than the first period, a first reading-out signal for reading-out from the light-receiving elements intermittently present in a vertical direction to the vertical transfer register a first electric charge generated by the first exposure, a second reading-out signal for reading-out from the light-receiving elements respectively assigned to vacant transfer areas in which no electric charge is present to the vertical transfer register a second electric charge generated by the second exposure, a vertical transfer signal for transferring the electric charge read-out to the vertical transfer register in a vertical direction, and a horizontal transfer signal for transferring in a horizontal direction the electric charge that reaches the horizontal transfer register by a transfer in accordance with the vertical transfer signal.

The processor generates one screen of a first image signal based on the first electric charge, and the second electric charge output from the imager by such the timing signals.

According to claim 24 of the present invention, an imager includes a vertical transfer register having a plurality of transfer areas, a horizontal transfer register connected to an output terminal of the vertical transfer register, and a plurality of light-receiving elements respectively assigned to the plurality of transfer areas. The exposure controller controls an exposure of the imager by an electric shutter system, and a reader reads out from a portion of the plurality of light-receiving elements to the vertical transfer register an electric charge generated by an exposure of the exposure controller. The electric charge read-out to the vertical transfer register

is transferred in a vertical direction by a vertical transfer, and the electric charge that reaches the horizontal transfer register is transferred in a horizontal direction by the horizontal transferor.

Herein, the exposure controller carries out a first exposure of a first period, and carries out after the first exposure a second exposure of a second period, which is shorter than the first period. The reader reads out from the light-receiving elements intermittently present in a vertical direction to the vertical transfer register a first electric charge generated by the first exposure, and reads out from the light-receiving elements respectively assigned to vacant transfer areas in which no electric charge is present to the vertical transfer register a second electric charge generated by the second exposure. The generator generates one screen of an image signal based on the first electric charge, and the second electric charge output from the imager.

In the both claims 18 and 24, the second exposure is executed after the first exposure, and the second period for the second exposure is shorter than the first period for the first exposure. In addition, the exposure of the imager is controlled by the electric shutter system. The electric shutter system is a system for defining an ending timing of the exposure by a reading-out or a sweeping of the electric charge, and therefore, the second exposure is to be ended by the sweeping of the electric charge.

However, the second period is shorter than the first period, and therefore, the vertical transfer of the first electric charge is not necessarily completed at the ending timing of the second period. In a case that there exists the first electric charge on the vertical transfer register at the ending timing of the second period, it is probable that the second electric charge read-out from the light-receiving element collide with the first electric charge. If such the collision is permitted,

it becomes impossible to generate the image signal having a dynamic range enlarged based on the first electric charge and the second electric charge.

Consequently, in the present invention, the first electric charge is to be read-out from the light-receiving element intermittently present in a vertical direction, and the second electric charge is to be read-out from the light-receiving element assigned to the vacant transfer area in which no electric charge exists. This results in the first electric charge and the second electric charge being aligned one after the other on the vertical transfer register without being mixed with each other.

As a result, it becomes possible to generate one screen of a composite image signal having the enlarged dynamic range based on the first electric charge and the second electric charge. Furthermore, the first electric charge and the second electric charge aligned on the vertical transfer register are output from the imager all at once, thus a reduction in time required for outputting, and therefore, possible to improve a frame rate of the composite image signal.

In contrast to this, in Fukui, the period T2 for the second exposure is longer than the period T1 for the first exposure. Because the period T2 is longer than the period T1, it is possible to complete outputting the electric charge based on the first exposure before the ending timing of the period T2. That is, in Fukui, the electric charge generated by the first exposure and the electric charge generated by the second exposure are outputted at timing different with each other. However, in such an output timing control, it is likely that the frame rate of the composite image signal will be decreased. Therefore, in Fukui, two horizontal transfer registers are prepared with the aim of preventing the frame rate from decreasing.

Thus, between the present invention and Fukui, a significant difference results from a difference in magnitude relationship of the exposure period regarding a manner of outputting the electric charge. Furthermore, Fukui fails to teach or remotely suggest any output control of the electric charge such as in the present invention.

Fukui also fails to disclose that the first charge created as a result of a first exposure is read from first light receiving elements which are arranged vertically intermittently, or that the second charge created as a result of a second exposure is read from second light receiving elements which are arranged vertically intermittently, as recited in newly-added claims 18 and 24 of the instant application.

Thus, the 35 USC §102(e) rejection should be withdrawn.

Claims 6 and 15 stand rejected under 35 USC §103(a) as unpatentable over Fukui.

Applicants respectfully traverse this rejection.

As noted above, Fukui fails to disclose the features recited in newly-added claims 18 and 24, from which all other claims depend.

Thus, the 35 USC §103(a) rejection should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims 18-29, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

U.S. Patent Application Serial No. 09/361,610

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosure: Substitute Abstract of the Disclosure

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